CLAIMS

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1. A gas flow transducer apparatus with immunity to vibration or acceleration, the apparatus comprising:

a plurality of gas flow transducer elements each sensitive to vibration or acceleration in at least one direction and generating an output signal proportional to gas flow and to a perturbation component resulting from said vibration or acceleration, said elements being arranged on a common support;

a plurality of gas flow passages leading gas flow from an inlet to an outlet through at least one of said elements;

said elements being arranged on said common support and connected to said passages such that at least one of said perturbation component and said gas flow is measured differently by said elements; and

circuitry receiving said output signal of each of said elements and outputting a vibration or acceleration immune output signal corresponding to said gas flow with said perturbation component substantially cancelled.

2. The apparatus as claimed in claim 1, wherein said gas flow passages cause said gas flow to be equal through said elements.

3. The apparatus as claimed in claim 2, wherein said gas flow is split between said elements.

4. The apparatus as claimed in claim 2, wherein said gas flow passes serially through said elements.

5. The apparatus as claimed in claim 4, wherein two said elements are provided that are sensitive to vibration or acceleration along only one axis and are arranged parallel to one another, said gas flow passages being arranged such that said gas flow is in opposite directions through said elements.

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6. The apparatus as claimed in claim 1, further comprising a gas throughflow blocking member preventing gas flow in at least one of said elements, wherein said at least one of said elements measures only said perturbation component.

7. The apparatus as claimed in claim 6, wherein said at least one of said elements communicates with said gas flow such that said at least one of said elements is subjected to a same gas composition and temperature as other ones of said elements.

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8. The apparatus as claimed in any one of claims 1 to 4, 6 and 7, wherein said elements are sensitive to vibration or acceleration along only one axis.

9. The apparatus as claimed in any one of claims 1 to 4, and 6 to 8, wherein said apparatus comprises two of said elements.

10. The apparatus as claimed in one of claims 1 to 9, wherein said elements comprise thermoanemometer-type transducers.

11. A gas flow receiver comprising:

a flow tube having a sidewall and guiding flow therethrough while inducing minimal resistance;

an upstream sensing tube having an upstream orifice communicating with said flow tube via said sidewall;

a downstream sensing tube having a downstream orifice communicating with said flow tube via said sidewall; and

a non-symmetrical-flow-inducing diaphragm mounted in said flow tube between said upstream and said downstream orifices, and causing non-symmetrical flow in said flow tube with an accentuated higher pressure near said upstream orifice than would be sensed in a corresponding cross-section of said flow tube and an accentuated lower pressure near said downstream orifice than would be sensed in a corresponding cross-section of said flow tube, said orifices being positioned with respect to said diaphragm so as to sense accentuated pressure substantially without sensing pressure oscillations due to any turbulence induced by said diaphragm.

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12. The gas flow receiver as claimed in claim 11, wherein said diaphragm is mounted to said sidewall between said orifices.

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13. The gas flow receiver as claimed in claim 11 or 12, wherein said diaphragm is shaped so as to exhibit high drag and generate maximum accentuated pressure for its size.

14. The gas flow receiver as claimed in claim 11, 12 or 13, wherein said flow tube has a smaller cross-section between said orifices and is similarly tapered on both sides of said small cross-section.

15. A method of estimating a value of an analog signal using an analog-to-digital converter (ADC) with a level of precision greater than a minimum quantization value of the ADC, the method comprising the steps of:

adding a secondary signal to said analog signal, said secondary signal having a zero DC component, a substantially even and symmetric amplitude distribution and a peak-to-peak amplitude greater than said minimum quantization value;

recording and storing a digital output value of the ADC;

averaging the digital output value recorded over a sampling period to obtain an estimated higher precision digital value with a precision greater than a precision of the digital output value.

16. The method as claimed in claim 15, wherein said secondary signal is provided by a noise signal.

17. The method as claimed in claim 16, wherein said noise signal is generated in amplifier circuitry used to amplify said analog signal.

18. The method as claimed in claim 15, 16 or 17, wherein said analog signal is a gas flow transducer signal, and said gas flow transducer is a thermoanemometer-type transducer apparatus.

19. The method as claimed in any one of claims 15 to 18, wherein said sampling period varies as a function of an amplitude of the analog signal, wherein said sampling period is longer for lower amplitude values and is shorter for higher amplitude values.

20. A method of filtering a signal comprising the steps of:

measuring an amplitude of the signal;

determining an averaging period τ as a function of said amplitude, wherein τ is longer for lower values of said amplitude and τ is shorter for higher values of said amplitude; and

averaging said amplitude over said period to provide a filtered output signal.

21. The method as claimed in claim 20, wherein said function is a step function.

22. The method as claimed in claim 20 or 21, wherein when said amplitude is above a predetermined threshold, said filtered output signal is the instantaneous value of said amplitude.

23. The method as claimed in claim 20, 21 or 22, wherein said step of measuring comprises converting an analog gas flow transducer signal to a digital signal providing said amplitude.

24. The method as claimed in claim 23, wherein said gas flow transducer is a thermoanemometer-type transducer apparatus.

25. A method of processing a transducer output signal that is non-linear with respect to a physical parameter being measured to obtain a calibrated output signal representing the physical parameter on a given scale, the method comprising:

subjecting said transducer to a number of calibrated physical parameter conditions;

recording a value of said output under each of said conditions;

obtaining an analytical solution for a non-linear function relating said output value to said physical parameter, said solution being expressed as:

$$F(V) = \sum_{i=1}^{N} A_i V^{\frac{i}{\alpha_i}}$$

where V is the transducer output signal; N is greater than or equal to 3; parameters A_i are coefficients determined from said recorded values; α_i are real numbers;

determining said calibrated output signal for said transducer output signal using said analytical solution.

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26. The method as claimed in claim 25, wherein α_i are greater than 1.

27. The method as claimed in claim 26, wherein α_i are non-integers.

28. The method as claimed in claim 25, 26 or 27, wherein said step of determining comprises:

calculating a value of said physical parameter for each possible value of said transducer output signal using said analytical solution; and

building a table of said physical parameter values indexed by digital output values;

converting said transducer output signal into a digital output value; and

obtaining a value of said calibrated output signal from said table using said digital output value.

29. The method as claimed in one of claims 25 to 28, wherein said analytical solution is exact for each of said recorded values.

30. The method as claimed in one of claims 25 to 29, wherein said analytical function is divided into subranges.

31. The method as claimed in one of claims 25 to 30, wherein said transducer output signal is derived from a gas flow transducer signal having at least one of a square and a near-square transfer function.

32. The method as claimed in claim 31, wherein said gas flow transducer is a thermoanemometer-type transducer apparatus.